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Trace elements in soils and vine from Tikves area-Republic of Macedonia with particular references to nickel distribution

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Abstract

The paper presents the research of the presence of elements in traces Al, Ba, Ca, Cu, K, Mg, Mn, Na, Sr, As, Cd, Co, Cr, Ni, Pb, Zn in the soil of the Tikves area and the wine which is produced from the grapevine grown on those soil. The determination of the presence of elements in traces is made according to the method ICP-AES, ETASS. Due to the quantity in the graphic interpretation (maps of correlation between wine/soil) in the paper only the graphic interpretations for the elements NI, are presented.

Keywords: wine, soil, elements in traces, Tikves.

Introduction

Vineculture and wine in Tikves area have a rich historical past and long tradition. They constitute the core industries of the population of the whole region.

The history of vines in this region goes back to more than two millennia, and that something can be seen from the numerous remnants of the past (archaeological artifacts in archeological sites such as: Stobi Eudarist, Belgrade, Antigone, Demir blackberry etc. .), written documents, photographs, stories, as well as folk songs, customs and other works (Cvijich, 1906).

Today, when we talk about viticulture in Macedonia, it immediately reminds us of the Tikves area, the Tikves grapes and wine which is mentioned in numerous native Macedonian folk songs. Today the Tikvesh wine area is one of the most important, both in Macedonia and the Balkans.

Results which refer to the determination of the elements in traces in the wine produces in the winetrade in Tikves area, as well as the rest of the wine regions in Republic of Macedonia can be found in the papers by: Julijana Cvetkovic, Sonja Arpadjanb, Irina Karadjova, Trajce Stafilov. (2002), Trajče Stafilov, Irina Karadjova (2009), Irina Karadjova, Julijana Cvetkovic, Trajce Stafilov, Sonja Arpadjan (2007), Irina Karadjova, Sonja Arpadjan, Julijana Cvetkovic and Trajce Stafilov (2004), Julijana Cvetković, Trajče Stafilov, Dragan Mihajlović (2001), Krste Tasev, Iirina Karadjova, Sonja Arpadjan, Julijana Cvetkovic, Trajce Stafilov (2004, 2006, 2005). Also, the results which refer to the geological, pedo-genetical and geo-chemical characteristics in the region Tikves and its surrounding can be found in the papers by: Blazo Boev *et all* (2005) and Trajce Stafilov *et all* (2008).

Materials and Methods

Field research methods are very important research activity of which depends greatly on further research results, and of course the performance of the final conclusions. In this Master work these methods are renamed in full in order to:

- detailed insight on the field that is the subject of research,,
- drafting outreach activities,
- sampling of soils while GPS positioning, packaging and labeling samples,
- photographing the developed profiles in soil horizons from which the samples are collected,
- record owners of vineyards whose grapes are collected soil samples and samples of wines,
- sampling of wines are produced at home conditions, packinglabeling.

The collection of soil samples was done in accordance with generally accepted methodologies for work, as the methodology FOREGS (methodology for the geochemical map of Europe).

The following methods of laboratory research were applied:

- Preparation of soil samples for geochemical and wine pursuits representation macroelements and trace elements (ISO-14507);
- Preparation of samples of soil and wine, according to ISO-11466;
- Determination of the macroelements and trace elements by applying the methods of ICP-AES and ETASS.

The researched elements are analysed by applying the atomic emission spectrometric method with double plasma (AES-ICP) and the method of electrothermal spectrometric atomic absorption (ETAAS). With the method of AES-ICP the following elements were simultaneously measured: Al, As, Ba, Ca, Co, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Sr, Zn.

The concentration of As, Cd, Co, Cr, Ni и Pb in the samples of wine were lower than the limitations of detection of AES-ICP and therefore they were analysed ETAAS. The instruments like: Varian 715-ES Series ICP Optical Emission Spectrometer (Varian, USA) and Zeeman ETAAS Varian SpectrAA-640Z were used for the analyses.

Results and discussion

The results for the presence of trace elements in soils are shown in Table 1(minimum, maximum and average values from 33 individual probes).

Table 1. Concentratios of the trace elements in the soil of Tikves area

Probe	Min	Average	Max
Al (mg/kg)	17978	30854	44972
As (mg/kg)	1,2	15,1	83
Ba (mg/kg)	145,1	315,2	717,7
Ca (mg/kg)	9140	40790	88862
Cd (mg/kg)	0	0,1	0,5
Co(mg/kg)	11	16,8	37,6
Cr(mg/kg)	30,6	99,9	442,4
Cu(mg/kg)	11,3	24,6	46,3
K(mg/kg)	4187	12031	19038
Mg(mg/kg)	3769	9751	23195
Mn(mg/kg)	397	568	794
Na(mg/kg)	3385	7003	13975
Ni(mg/kg)	24	78,7	528,5
Pb(mg/kg)	1,9	14,1	24,9
Sr(mg/kg)	40,9	129,5	401,6
Zn(mg/kg)	33,2	48,7	72,4

In the very same manner the results for the presence of trace elements in wine are shown in Table 2 (minimum, maximum and average values from 33 individual probes).

The results indicate an increased prevalence of correlativity between Ni in soils and wine (Fig. 1). The correlation with the contents of Ni in soils and wine can be explained by the large contamination of soils with nickel due to metallurgical activity in the region.

Table 2. Concentration of the trace elements in vine from Tikves area

Probe	Min	Average	Max
Al (mg/l)	0,1	0,71	4,93
Ba (mg/l)	0,06	0,2	0,47
Ca (mg/l)	19,77	49,64	105,16
Cu (mg/l)	0,009	0,196	1,389
K (mg/l)	323,5	835,9	1626,4
Mg (mg/l)	23,92	85,06	130,52
Mn (mg/l)	0,46	1,32	3
Na (mg/l)	1,05	8,9	63,91
Sr (mg/l)	0,15	0,99	2,88
As (µg/l)	1,28	46,91	128,74
Cd (µg/ml)	0,09	1	5,32
Co (µg/l)	0,18	2,56	10,57
Cr (µg/l)	1,37	11,98	99,53
Ni (µg/l)	6,71	43,92	313,83
Pb (µg/l)	6,02	58,53	289,79
Zn (µg/ml)	0,04	0,35	0,9

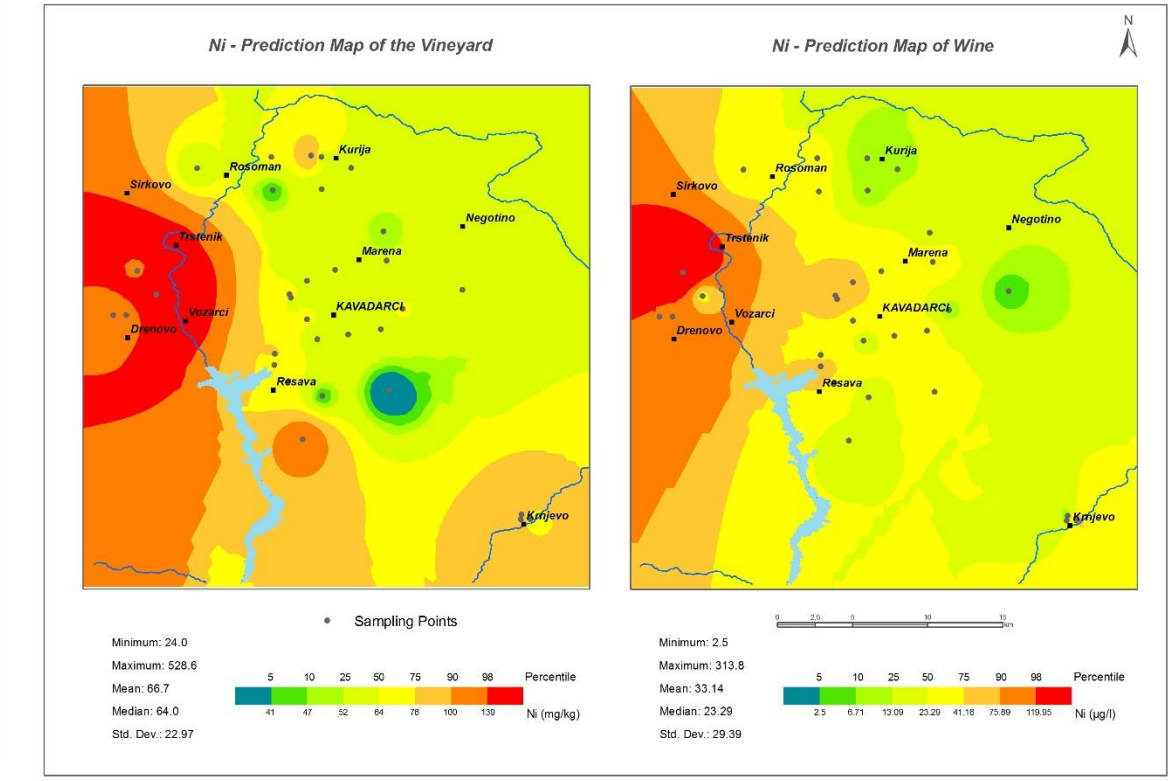

Fig.1. Map distribution of Ni in the soil/vine

Conclusion

From the surveys on the presence of trace elements in soils and in the wine of Tikves region winery expressed correlative relationships among elements Ni, can be concluded.

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